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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

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CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

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REPORT
ON
DOCTORS LAKE
CLAY COUNTY
FLORIDA
EPA REGION IV
WORKING PAPER No. 247

WITH THE COOPERATION OF THE
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
AND THE
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OCTOBER, 1977

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Florida Department of Environmental Regulation for professional involvement and to the Florida National Guard for conducting the tributary sampling phase of the Survey.

Joseph W. Landers, Jr., Secretary of the Department of Environmental Regulation; John A Redmond, former Director of the Division of Planning, Technical Assistance, and Grants; and Dr. Tim S. Stuart, Chief of the Bureau of Water Quality, provided invaluable lake documentation and counsel during the survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

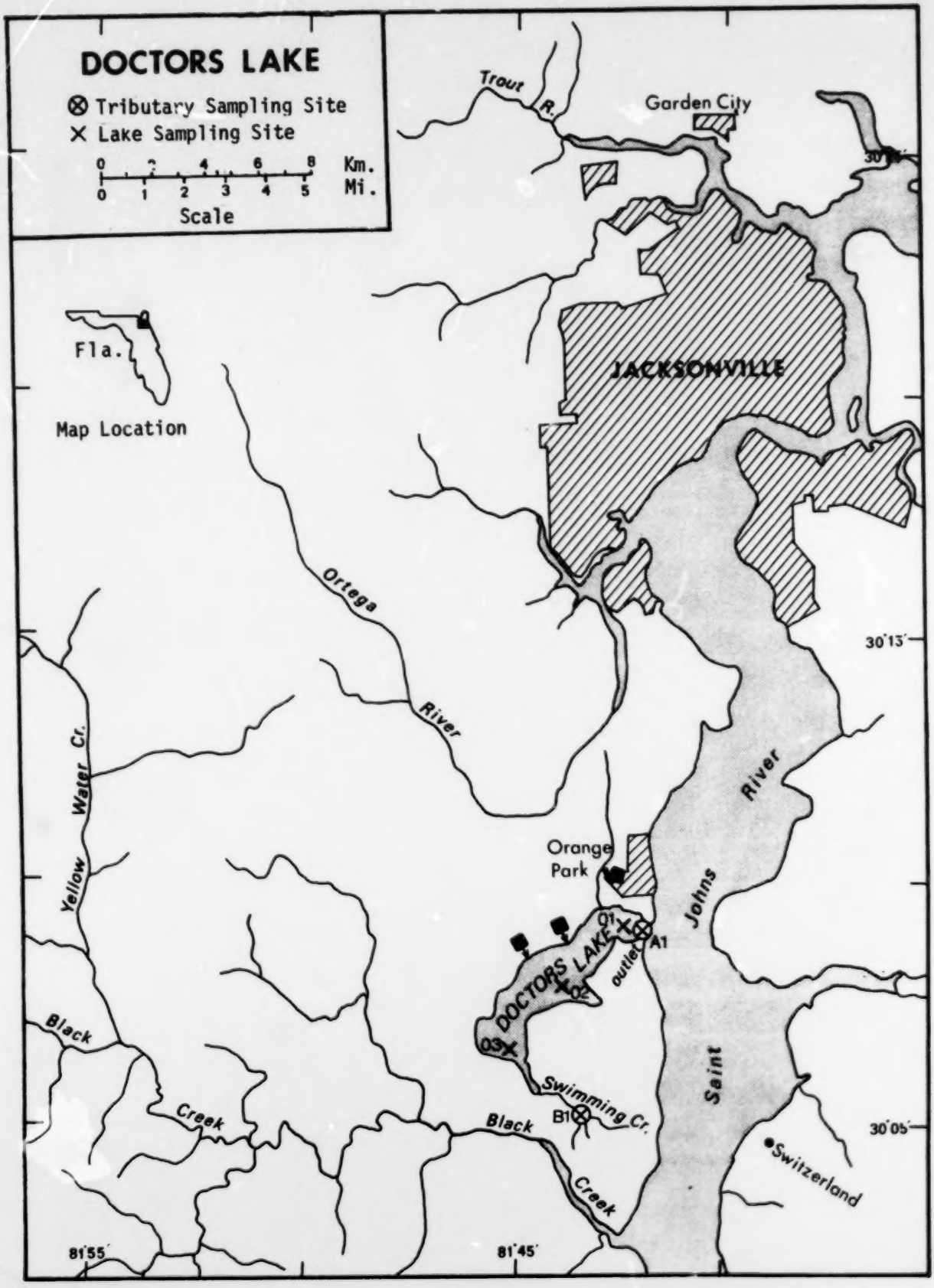
Major General Henry W. McMillan (Retired), then the Adjutant General of Florida, and Project Officer Colonel Hugo F. Windham, who directed the volunteer efforts of the Florida National Guard, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF FLORIDA

LAKE NAME	COUNTY
Alligator	Columbia
Apopka	Lake, Orange
Banana	Polk
Crescent	Flagler, Putnam
Doctors	Clay
Dora	Lake
East Tohopekaliga	Osceola
Effie	Polk
Eloise	Polk
George	Putnam, Volusia
Gibson	Polk
Glenada	Highlands
Griffin	Lake
Haines	Polk
Hancock	Polk
Horseshoe	Seminole
Howell	Orange, Seminole
Istokpoga	Highlands
Jessie	Polk
Jessup	Seminole
Kissimmee	Osceola
Lawne	Orange
Lulu	Polk
Marion	Polk
Minnehaha	Orange
Minneola	Lake
Monroe	Seminole, Volusia
Munson	Leon
Okeechobee	Glades, Hendry, Martin, Okeechobee, Palm Beach
Poinsett	Brevard, Orange, Osceola
Reedy	Polk
Seminole	Jackson, FL; Decatur, Seminole, GA
Seminole	Pinellas
South	Brevard
Talquin	Gadsden, Leon
Tarpon	Pinellas
Thonotosassa	Hillsborough
Tohopekaliga	Osceola
Trout	Lake
Weohyakapka	Polk
Yale	Lake


DOCTORS LAKE
Tributary Sampling Site
Lake Sampling Site
0 2 4 6 8 Km.
0 1 2 3 4 5 Mi.
Scale
Fla.
Map Location
Trout R.
Garden City
30°21'
JACKSONVILLE
Ortega River
Yellow Water Cr.
30°13'
Orange Park
Johns River
C1
A1
outlet
DOCTORS LAKE
C2
C3
Black Creek
Swimming Cr.
B1
Black Creek
Saint
30°05'
Switzerland
81°55'
81°45'

DOCTORS LAKE

STORET NO. 1207

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Doctors Lake is eutrophic. It ranked seventeenth in overall trophic quality when the 41 Florida lakes sampled in 1973 were compared using a combination of six lake parameters*. Sixteen of the lakes had less median total phosphorus, 16 had less and one had the same median dissolved phosphorus, nine had less and one had the same median inorganic nitrogen, 17 had less mean chlorophyll a, and 16 had greater mean Secchi disc transparency.

Survey limnologists noted extensive beds of floating and emergent macrophytes near each of the three sampling stations during one or more visits and observed a bloom of filamentous algae along the shoreline near station 3 in November.

B. Rate-Limiting Nutrient:

The algal assay results indicate Doctors Lake was nitrogen limited at the time the sample was collected (03/07/73). The lake data indicate nitrogen limitation each sampling time at stations 1 and 3 and at the second and last sampling times at station 2.

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* See Appendix A.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Doctors Lake received a total phosphorus loading nearly three times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 13). Approximately 89% of this load came from three Orange Park sewage treatment plants. However, these plants were closed in March and April of 1975, and the wastewater was diverted to larger plants which discharge to St. Johns River downstream from Doctors Lake (Dutton, 1975). Based on the sampling year data, this reduced the total phosphorus loading rate to 0.08 $g/m^2/yr$ which is less than Vollenweider's proposed oligotrophic loading. It is likely that the trophic condition of the lake will improve significantly once a new phosphorus equilibrium is established, and phosphorus more frequently becomes the limiting nutrient.

2. Non-point sources--Direct precipitation was the major non-point source of phosphorus during the sampling year, contributing about 6% of the total phosphorus load. Minor tributaries and immediate drainage and Swimming Creek contributed about 4% and 1% of the total phosphorus load respectively.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††

1. Surface area: 12.96 kilometers^2.
2. Mean depth: 3.0 meters.
3. Maximum depth: 4.0 meters.
4. Volume: 38.880 x 10^6 m^3.
5. Mean hydraulic retention time: 1.7 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Swimming Creek	7.8	0.13
Minor tributaries & immediate drainage -	37.2	0.59
Totals	45.0	0.72

2. Outlet -

Doctors Inlet	58.0**	0.72

C. Precipitation***:

1. Year of sampling: 158.7 centimeters.
2. Mean annual: 135.5 centimeters.

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† Table of metric equivalents - Appendix B.
†† Morphometry calculated from depth contours on U.S.G.S. Fleming Island, Orange Park, Jacksonville Heights, and Middleburg quad maps.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973 - 1975".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Doctors Lake was sampled three times in 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from one or more depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 4.9 meters at station 1, 2.7 meters at station 2, and 1.5 meters at station 3.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR DOCTORS LAKE
STORET CODE 1207

PARAMETER	1ST SAMPLING (3/ 7/73) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (9/ 7/73) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (11/ 8/73) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	17.8 - 23.2	19.5	18.9	28.9 - 30.2	29.5	29.3	20.1 - 21.9	21.2	21.3
DISS OXY (MG/L)	5.1 - 9.2	7.8	8.0	4.4 - 7.0	5.5	5.4	6.2 - 7.4	6.9	7.0
CNDCTVY (MCROMO)	810. - 1800.	1313.	1450.	716. - 806.	775.	790.	704. - 7233.	3979.	3988.
PH (STAND UNITS)	7.6 - 8.8	8.2	8.2	7.9 - 8.7	8.4	8.4	7.0 - 7.9	7.3	7.3
TOT ALK (MG/L)	38. - 44.	42.	42.	25. - 48.	42.	48.	57. - 66.	61.	61.
TOT P (MG/L)	0.062 - 0.091	0.074	0.067	0.083 - 0.097	0.088	0.086	0.075 - 0.117	0.094	0.092
ORTHO P (MG/L)	0.011 - 0.048	0.025	0.012	0.021 - 0.038	0.030	0.030	0.016 - 0.098	0.055	0.053
NO2+NO3 (MG/L)	0.040 - 0.280	0.137	0.085	0.030 - 0.030	0.030	0.030	0.010 - 0.240	0.124	0.125
AMMONIA (MG/L)	0.050 - 0.260	0.094	0.055	0.040 - 0.050	0.047	0.050	0.030 - 0.080	0.052	0.050
KJEL N (MG/L)	1.200 - 1.800	1.425	1.450	1.400 - 2.000	1.800	1.900	1.100 - 1.600	1.262	1.200
INORG N (MG/L)	0.090 - 0.370	0.231	0.250	0.070 - 0.080	0.077	0.080	0.040 - 0.320	0.176	0.175
TOTAL N (MG/L)	1.280 - 2.080	1.562	1.505	1.430 - 2.030	1.830	1.930	1.210 - 1.840	1.386	1.330
CHLRPYL A (UG/L)	6.6 - 43.5	27.2	31.6	28.0 - 41.3	36.2	39.2	3.1 - 26.6	17.9	24.0
SECCHI (METERS)	0.8 - 0.8	0.8	0.8	0.9 - 0.9	0.9	0.9	0.7 - 1.5	1.0	0.8

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
03/07/73	1. Melosira sp.	876
	2. Microcystis sp.	666
	3. Kirchneriella sp.	543
	4. Merismopedia sp.	434
	5. Scenedesmus sp.	318
	Other genera	1,295
	Total	4,132
09/07/73	1. Oscillatoria sp.	15,708
	2. Dactylococcopsis sp.	11,396
	3. Centric diatoms	5,544
	4. Lyngbya sp.	5,236
	5. Merismopedia sp.	1,694
	Other genera	13,860
	Total	53,438
11/08/73	1. Oscillatoria sp.	11,678
	2. Dactylococcopsis sp.	11,293
	3. Flagellates	3,337
	4. Scenedesmus sp.	2,695
	5. Microcystis sp.	2,566
	Other genera	11,291
	Total	42,860

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
03/02/73	1	6.6
	2	43.5
	3	31.6
09/07/73	1	28.0
	2	39.2
	3	41.3
11/08/73	1	3.1
	2	26.6
	3	24.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.036	0.156	4.7
0.050 P	0.086	0.156	4.4
0.050 P + 1.0 N	0.086	1.156	20.0
1.0 N	0.036	1.156	9.8

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Doctors Lake was moderately high at the time the assay sample was collected (03/07/73). Also, the increased yield when only nitrogen was added and the lack of response when orthophosphorus alone was added indicate that the lake was nitrogen limited when at that time.

With the exception of sampling station 2 during the first visit (mean N/P ratio = 20/1), the lake data indicate nitrogen limitation at all sampling times (i.e., the mean inorganic nitrogen to orthophosphorus ratios were less than 9 to 1).

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Florida National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v). Sampling was begun in March, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Florida District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/year$, at station B-1 and multiplying by the ZZ area in km^2.

The operators of the Orange Park sewage treatment plants did not participate; nutrient loads from these sources were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 m^3/capita/day.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal* -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)**	Receiving Water
Orange Park -				
Robinette SD	203	act. sludge	76.8	Doctors Lake
Grove Park SD	5,554	act. sludge	2,102.2	Spring Branch
Lakeside Estates SD	2,040	act. sludge	772.1	Lucy Branch

2. Known industrial - None

* Avery, 1975; Dutton, 1975.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Swimming Creek	80	0.8
b. Minor tributar es & immediate drainage (non-point load) -	380	3.9
c. Known municipal STP's		
Orange Park -		
Robinette SD	230	2.3
Grove Park SD	6,300	63.5
Lakeside Estates SD	2,315	23.3
d. Septic tanks* -	40	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	570	5.8
Total	9,915	100.0

2. Outputs -

Lake outlet - Doctors Inlet 2,295

3. Net annual P accumulation - 7,620 kg.

* Estimate based on 137 lakeshore dwellings; see Working Paper No. 175.
** Brezonic and Shannon, 1971.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Swimming Creek	8,075	9.8
b. Minor tributaries & immediate drainage (non-point load) -	38,510	46.9
c. Known municipal STP's -		
Orange Park -		
Robinette SD	690	0.8
Grove Park SD	18,890	23.0
Lakeside Estates SD	6,940	8.5
d. Septic tanks* -	1,460	1.8
e. Known industrial	-	-
f. Direct precipitation** -	7,520	9.2
Total	82,085	100.0

2. Outputs -

Lake outlet - Doctors Inlet 70,110

3. Net annual N accumulation - 11,975 kg.

* Estimate based on 137 lakeshore dwellings; see Working Paper No. 175.
** Brezonic and Shannon, 1971.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Swimming Creek	10	1,035

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Note, however, that Florida lakes may be able to assimilate phosphorus at a somewhat higher level than that suggested by Vollenweider (Shannon and Brezonik, 1972).

Essentially, Vollenweider's "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.77	0.59	6.3	0.9

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Doctors Lake:

"Dangerous" (eutrophic rate)	0.26
"Permissible" (oligotrophic rate)	0.13

V. LITERATURE REVIEWED

Avery, Raymond, 1975. Personal communication (Orange Park wastewater treatment plants). Kingsley Utility Serv., Orange Park.

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Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690. Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	1231	LAKE MONROE	215
30	1217	LAKE HANCOCK	213
31	1252	LAKE ELOISE	207
32	1264	PAYNE'S PRAIRIE LAKE (NO	206
33	1220	LAKE HOWELL	201
34	1203	LAKE BANANA	200
35	1223	LAKE JESSUP	184
36	1201	ALLIGATOR LAKE	130
37	1242	TROUT LAKE	110
38	1249	LAKE LAWNE	98
39	1247	LAKE MUNSON	58
40	1227	LAKE LULU	34
41	1209	LAKE EFFIE	31

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1230	LAKE MINNEOLA	579
2	1261	EAST LAKE TOHOPEKALIGA	523
3	1229	LAKE MINNEHAHA	517
4	1243	LAKE WEOHYAKAPKA	495
5	1250	LAKE TARPON	491
6	1221	LAKE ISTOKPOGA	477
7	1246	LAKE YALE	467
8	1224	LAKE KISSIMMEE	455
9	1258	LAKE JESSIE	419
10	1219	LAKE HORSESHOE	406
11	1215	LAKE HAINES	396
12	1238	LAKE SOUTH	386
13	1232	LAKE OKEECHOBEE	368
14	1228	LAKE MARION	366
15	1206	LAKE CRESCENT	346
16	1234	LAKE POINSETT	342
17	1207	DOCTORS LAKE	341
18	1236	LAKE REEDY	337
19	1211	LAKE GIBSON	324
20	1208	LAKE DORA	297
21	1239	LAKE TALQUIN	294
22	1202	LAKE APOPKA	280
23	1212	GLENADA LAKE	276
24	1214	LAKE GRIFFIN	273
25	1240	LAKE THONOTOSASSA	266
26	1248	LAKE SEMINOLE	260
27	1210	LAKE GEORGE	256
28	1241	LAKE TOHOPEKALIGA	229

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1240	LAKE THONOTOSASSA	20 (8)	85 (34)	58 (23)	40 (16)	48 (18)	15 (6)	266
1241	LAKE TOHOPEKALIGA	33 (13)	40 (16)	38 (15)	48 (19)	40 (16)	30 (12)	229
1242	TROUT LAKE	15 (6)	8 (3)	43 (17)	23 (9)	13 (5)	8 (3)	110
1243	LAKE WEOHYAKAPKA	75 (30)	91 (36)	83 (33)	88 (35)	74 (29)	84 (33)	495
1246	LAKE YALE	98 (39)	58 (23)	90 (36)	63 (25)	83 (32)	75 (30)	467
1247	LAKE MUNSON	8 (3)	5 (2)	8 (3)	8 (3)	16 (6)	13 (5)	58
1248	LAKE SEMINOLE	35 (14)	48 (19)	35 (14)	10 (4)	69 (27)	63 (25)	260
1249	LAKE LAWNE	0 (0)	0 (0)	0 (0)	20 (8)	43 (17)	35 (14)	98
1250	LAKE TARPON	83 (33)	98 (38)	100 (40)	90 (36)	60 (23)	60 (24)	491
1252	LAKE ELOISE	30 (12)	50 (20)	63 (25)	28 (11)	16 (6)	20 (8)	207
1258	LAKE JESSIE	73 (29)	88 (35)	88 (35)	60 (24)	26 (10)	84 (33)	419
1261	EAST LAKE TOHOPEKALIGA	80 (32)	98 (38)	93 (37)	98 (39)	55 (22)	99 (39)	523
1264	PAYNE'S PRAIRIE LAKE (NO	11 (4)	65 (26)	25 (10)	15 (6)	90 (35)	0 (0)	206

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1201	ALLIGATOR LAKE	25 (10)	29 (10)	30 (12)	18 (7)	10 (4)	18 (7)	130
1202	LAKE APOPKA	50 (20)	38 (15)	10 (4)	38 (15)	74 (29)	70 (28)	280
1203	LAKE BANANA	23 (9)	29 (10)	20 (8)	5 (2)	100 (40)	23 (9)	200
1206	LAKE CRESCENT	65 (26)	70 (27)	33 (13)	80 (32)	48 (18)	50 (20)	346
1207	DOCTORS LAKE	60 (24)	76 (30)	60 (24)	55 (22)	34 (12)	56 (22)	341
1208	LAKE DORA	53 (21)	35 (14)	18 (7)	33 (13)	90 (35)	68 (27)	297
1209	LAKE EFFIE	5 (2)	10 (4)	3 (1)	3 (1)	0 (0)	10 (4)	31
1210	LAKE GEORGE	45 (18)	54 (21)	48 (19)	43 (17)	23 (9)	43 (17)	256
1211	LAKE GIBSON	40 (16)	81 (32)	45 (18)	70 (28)	48 (18)	40 (16)	324
1212	GLENADA LAKE	43 (17)	54 (21)	85 (34)	53 (21)	3 (1)	38 (15)	276
1214	LAKE GRIFFIN	48 (19)	29 (10)	23 (9)	30 (12)	95 (38)	48 (19)	273
1215	LAKE HAINES	70 (28)	81 (32)	75 (30)	58 (23)	34 (12)	78 (31)	396
1217	LAKE HANCOCK	18 (7)	43 (17)	13 (5)	13 (5)	98 (39)	28 (11)	213
1219	LAKE HORSESHOE	93 (37)	70 (27)	80 (32)	78 (31)	20 (8)	65 (26)	406
1220	LAKE HOWELL	11 (4)	23 (9)	69 (27)	35 (14)	60 (23)	3 (1)	201
1221	LAKE ISTOKPOGA	85 (34)	76 (30)	65 (26)	93 (37)	69 (27)	89 (35)	477
1223	LAKE JESSUP	28 (11)	18 (7)	5 (2)	25 (10)	83 (32)	25 (10)	184
1224	LAKE KISSIMMEE	90 (36)	63 (25)	73 (29)	65 (26)	65 (26)	99 (39)	455
1227	LAKE LULU	3 (1)	3 (1)	15 (6)	0 (0)	8 (3)	5 (2)	34
1228	LAKE MARION	78 (31)	29 (10)	53 (21)	50 (20)	83 (32)	73 (29)	366
1229	LAKE MINNEHAHA	88 (35)	91 (36)	95 (38)	85 (34)	78 (31)	80 (32)	517
1230	LAKE MINNEOLA	100 (40)	98 (38)	98 (39)	100 (40)	90 (35)	93 (37)	579
1231	LAKE MONROE	38 (15)	15 (6)	28 (11)	75 (30)	26 (10)	33 (13)	215
1232	LAKE OKEECHOBEE	68 (27)	45 (18)	40 (16)	73 (29)	53 (21)	89 (35)	368
1234	LAKE POINSETT	58 (23)	60 (24)	50 (20)	95 (38)	34 (12)	45 (18)	342
1236	LAKE REEDY	95 (38)	13 (5)	55 (22)	45 (18)	34 (12)	95 (38)	337
1238	LAKE SOUTH	63 (25)	70 (27)	69 (27)	68 (27)	60 (23)	56 (22)	386
?	LAKE TALQUIN	55 (22)	20 (8)	78 (31)	83 (33)	5 (2)	53 (21)	294

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1240	LAKE THONOTOSASSA	0.695	0.095	466.167	37.700	10.200	0.565
1241	LAKE TOHOPEKALIGA	0.246	0.200	472.917	30.633	10.500	0.152
1242	TROUT LAKE	1.110	0.650	472.000	76.967	12.900	0.470
1243	LAKE WEOHYAKAPKA	0.047	0.080	458.667	7.767	8.200	0.011
1246	LAKE YALE	0.027	0.160	441.000	25.367	7.600	0.014
1247	LAKE MUNSON	1.475	0.925	486.667	140.317	12.200	0.852
1248	LAKE SEMINOLE	0.234	0.175	473.833	102.000	8.600	0.026
1249	LAKE LAWNE	2.560	1.350	494.667	84.900	10.400	0.117
1250	LAKE TARPON	0.041	0.070	400.889	6.867	9.000	0.027
1252	LAKE ELOISE	0.486	0.170	465.333	70.233	12.200	0.339
1258	LAKE JESSIE	0.051	0.090	452.667	26.300	10.800	0.011
1261	EAST LAKE TOHOPEKALIGA	0.042	0.070	440.833	5.167	9.400	0.007
1264	PAYNE'S PRAIRIE LAKE (NO	1.260	0.140	476.000	88.200	7.400	1.210

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1240	LAKE THONOTOSASSA	0.695	0.095	466.167	37.700	10.200	0.565
1241	LAKE TOHOPEKALIGA	0.246	0.200	472.917	30.633	10.500	0.152
1242	TROUT LAKE	1.110	0.650	472.000	76.967	12.900	0.970
1243	LAKE WEOHYAKAPKA	0.047	0.080	458.667	7.767	8.200	0.011
1246	LAKE YALE	0.027	0.160	441.000	25.367	7.600	0.014
1247	LAKE MUNSON	1.475	0.925	486.667	140.317	12.200	0.852
1248	LAKE SEMINOLE	0.234	0.175	473.833	102.000	8.600	0.026
1249	LAKE LAWNE	2.560	1.350	494.667	84.900	10.400	0.117
1250	LAKE TARPON	0.041	0.070	400.889	6.867	9.000	0.027
1252	LAKE ELOISE	0.486	0.170	465.333	70.233	12.200	0.339
1258	LAKE JESSIE	0.051	0.090	452.667	26.300	10.800	0.011
1261	EAST LAKE TOHOPEKALIGA	0.042	0.070	440.833	5.167	9.400	0.007
1264	PAYNE'S PRAIRIE LAKE (NO	1.260	0.140	476.000	88.200	7.400	1.210

APPENDIX C

TRIBUTARY FLOW DATA

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

STORET RETRIEVAL DATE 76/02/10

120781
30 05 00.0 081 43 30.0
SWIMMING PEN CREEK
12 7.5 FLEMING ISLA
1/DOCTORS LAKE
RD JUST NW OF FLEMING ISLAND AIRFIELD
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/17	10	30	0.025	3.600	0.120	0.017	0.025
73/05/20	22	30	0.025	2.300	0.096	0.005K	0.030
73/06/14	13	30	0.033	3.780	0.078	0.013	0.030
73/07/16	11	40	0.011	0.720	0.029	0.009	0.015
73/08/18	10	07	0.014	1.600	0.084		0.015
73/09/15	10	30	0.012	1.540	0.072	0.011	0.011
74/02/17	15	30	0.044	0.300	0.010	0.010	0.015

STORET RETRIEVAL DATE 76/02/10

1207A1
30 09 00.0 081 42 00.0
DOCTORS INLET
12 7.5 ORANGE PARK
0/DOCTORS LAKE
US HWY 17 BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/17	10 00		0.168	9.450	0.260	0.042	0.155
73/04/13	14 35		0.120	5.200	0.120	0.040	0.085
73/05/20	22 20		0.023	3.100	0.132	0.035	0.110
73/06/14	13 50		0.042	5.300	0.231	0.056	0.105
73/07/16	12 08		0.110	0.880	0.025	0.063	0.095
73/08/18	10 37		0.010K	1.380	0.071	0.066	0.100
73/09/15	11 10		0.063	1.540	0.040	0.068	0.095
73/10/14	08 03		0.069	0.900	0.031	0.046	0.085
73/11/16	16 30		0.084	0.850	0.024	0.060	0.100
73/12/14	11 30		0.168	0.800	0.020	0.076	0.115
74/01/19	10 30		0.300	1.100	0.032	0.072	0.105
74/02/17	16 00		0.460	0.800	0.030	0.060	0.110

25

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/02/10

120703
30 06 16.0 081 44 59.0
DOCTORS LAKE
12 FLORIDA

11EPALES 2111202
3 0007 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/07	15 50	0000	0.064	31.6
	15 50	0004	0.069	
73/09/07	12 30	0000	0.083	41.3
73/11/08	10 00	0000	0.075	24.0
	10 00	0005	0.082	

STORET RETRIEVAL DATE 76/02/10

120703
30 06 16.0 081 44 59.0
DOCTORS LAKE
12 FLORIDA

11EPALES
3

2111202
0007 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/07	15	50 0000	23.2		31	1300	8.80	40	0.050	1.600	0.050	0.012
	15	50 0004	21.2	8.8		1600	8.50	38	0.050	1.400	0.040	0.011
73/09/07	12	30 0000	29.3	5.0	35	716	7.90	25	0.050	2.000	0.030	0.022
73/11/08	10	00 0000	20.7		26	717	7.90	57	0.040	1.300	0.010	0.019
	10	00 0005	20.1	7.4		704	7.40	57	0.040	1.200	0.020	0.028

STORET RETRIEVAL DATE 76/02/10

120702
30 07 53.0 081 43 59.0
DOCTORS LAKE
12 FLORIDA

11EPALES 2111202
3 0012 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/07	15 10	0000	0.066	43.5
	15 10	0004	0.062	
	15 10	0008	0.065	
73/09/07	12 40	0000	0.084	39.2
73/11/08	10 30	0000	0.077	26.6
	10 30	0007	0.085	

STORET RETRIEVAL DATE 76/02/10

120702
30 07 53.0 081 43 59.0
DOCTORS LAKE
12 FLORIDA

11EPALES
3

2111202
0012 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/07	15 10	0000	19.5		30	1700	8.20	42	0.140	1.500	0.060	0.011
	15 10	0004	19.4	9.2		1650	8.20	41	0.060	1.200	0.080	0.012
	15 10	0008	17.8	5.1		1800	8.10	44	0.260	1.500	0.090	0.011
73/09/07	12 40	0000	30.1	7.0	34	790	8.70	48	0.050	2.000	0.030	0.021
	12 40	0009	29.2			806						
73/11/08	10 30	0000	21.1		30	740	7.30	58	0.030	1.200	0.010	0.016
	10 30	0007	20.6	7.2		746	7.30	59	0.040	1.400	0.020	0.028

30

STORET RETRIEVAL DATE 76/02/10

120701
30 09 00.0 081 42 15.0
DOCTORS LAKE
12 FLORIDA

11EPALES 2111202
3 0010 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/07	14	15 0000	0.091	6.6
	14	15 0004	0.089	
	14	15 0008	0.090	
73/09/07	12	55 0000	0.088	28.0
	12	55 0008	0.097	
73/11/08	12	20 0000	0.117	3.1
	12	20 0005	0.110	
	12	20 0010	0.105	
	12	20 0016	0.099	

STORET RETRIEVAL DATE 76/02/10

120701
30 09 00.0 081 42 15.0
DOCTORS LAKE
12 FLORIDA

11EPALES
3

2111202
0010 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/07	14	15 0000	18.5		30	810	7.60	43	0.090	1.800	0.280	0.048
	14	15 0004	18.4	8.0		815	7.70	42	0.050	1.200	0.250	0.046
	14	15 0008	18.3	8.0		825	8.20	43	0.050	1.200	0.250	0.047
73/09/07	12	55 0000	30.2	5.8	34	791	8.70	47	0.050	1.800	0.030	0.038
	12	55 0008	28.9	4.4		770	8.20	48	0.040	1.400	0.030	0.038
73/11/08	12	20 0000	21.7		60	7233	7.00	66	0.080	1.600	0.240	0.098
	12	20 0005	21.9	6.2		7231	7.20	64	0.060	1.100	0.230	0.090
	12	20 0010	21.6	7.0		7230	7.20	64	0.060	1.200	0.230	0.086
	12	20 0016	21.6	6.6		7232	7.40	63	0.070	1.100	0.230	0.079

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A

APPENDIX D

PHYSICAL and CHEMICAL DATA

TRIBUTARY FLOW INFORMATION FOR FLORIDA 02/10/76

LAKE CODE 1207 DOCTORS LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 58.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1207A1	58.0	0.57	0.88	0.85	0.48	0.37	0.48	0.79	1.13	1.22	0.99	0.37	0.51	0.72
1207B1	7.8	0.10	0.16	0.15	0.08	0.07	0.08	0.14	0.20	0.22	0.18	0.07	0.09	0.13
1207ZZ	36.3	0.45	0.74	0.71	0.40	0.31	0.40	0.65	0.93	0.99	0.82	0.31	0.42	0.59

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 58.0
SUM OF SUB-DRAINAGE AREAS = 44.0

TOTAL FLOW IN = 8.66
TOTAL FLOW OUT = 8.64

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1207A1	3	73	2.04	17	0.0				
	4	73	3.03	13	0.0				
	5	73	0.03	20	0.0				
	6	73	0.93	14	0.0				
	7	73	0.40	16	0.0				
	8	73	1.42	18	0.0				
	9	73	1.08	15	0.0				
	10	73	0.31	14	0.0				
	11	73	-0.31	16	0.0				
	12	73	0.99	14	0.0				
	1	74	0.0	19	0.0				
	2	74	0.06	17	0.0				
1207B1	3	73	0.22	17	0.10				
	4	73	0.40	13	0.12				
	5	73	0.04	20	0.02				
	6	73	0.21	14	0.02				
	7	73	0.09	16	0.05				
	8	73	0.22	18	0.10				
	9	73	0.12	15	0.20				
	10	73	0.05	14	0.05				
	11	73	0.02	16	0.02				
	12	73	0.10	14	0.04				
	1	74	0.04	19	0.03				
	2	74	0.05	17	0.03				
1207ZZ	3	73	1.02	17	0.48				
	4	73	1.87	13	0.59				
	5	73	0.19	20	0.10				
	6	73	0.96	14	0.11				
	7	73	0.42	16	0.24				
	8	73	1.02	18	0.45				
	9	73	0.57	15	0.91				
	10	73	0.24	14	0.24				
	11	73	0.09	16	0.07				
	12	73	0.48	14	0.20				
	1	74	0.20	19	0.13				
	2	74	0.24	17	0.08				